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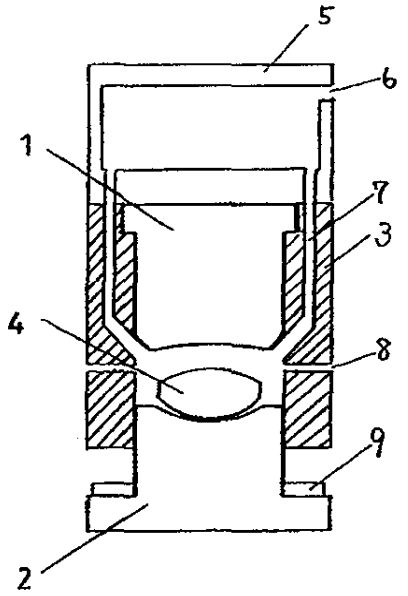
(54)【発明の名称】　ガラス光学素子の成形装置

(57)【要約】

【目的】　成形品の上型付着を防止し、無理のない離型を連続的にかつ安定して行うことができる光学素子の成形装置を提供すること。

【構成】　ガラス素材４を上型１、下型２及び胴型３から成る成形型に収容して所望温度に加熱した状態でプレス成形し、その後冷却し、離型することにより所望の光学機能面を有するガラス光学素子を成形する成形装置において、胴型内に冷却ガス通路７と冷却ガス吐出通路８を少なくとも一対設け、該冷却ガス通路は胴型上部に冷却ガスの流入口と、成形位置の成形品の外周面に向けて開口する流出口とを有し、前記冷却ガス吐出通路は成形位置の成形品の外周面とほぼ同じ高さ位置にあることを特徴とするガラス光学素子の成形装置である。



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【特許請求の範囲】

【請求項1】　ガラス素材を上型、下型及び胴型から成る成形型に収容して所望温度に加熱した状態でプレス成形し、その後冷却し、離型することにより所望の光学機能面を有するガラス光学素子を成形する成形装置において、胴型内に冷却ガス通路と冷却ガス吐出通路を少なくとも一対設け、該冷却ガス通路は胴型上部に冷却ガスの流入口と、成形位置の成形品の外周面に向けて開口する流出口とを有し、前記冷却ガス吐出通路は成形位置の成形品の外周面とほぼ同じ高さ位置にあることを特徴とするガラス光学素子の成形装置。

【請求項2】　冷却ガス通路を胴型内の上型外周面に近い部分に設けた請求項1記載のガラス光学素子の成形装置。

【請求項3】　冷却ガス通路に冷却ガス供給装置を設けた請求項1記載のガラス光学素子の成形装置。

【請求項4】　成形位置にあるときに、成形品の外周部に金型を移動することなく、上型、下型及び胴型で囲まれる空間が形成される請求項1～3のいずれか1項に記載のガラス光学素子の成形装置。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、光学機能面を有するガラス光学素子を直接プレス成形するダイレクトプレス法の実施に使用される成形装置に関する。

【0002】

【従来技術及びその問題点】ダイレクトプレス法において、成形完了時成形品の光学面と、それに対応する金型の成形面は、オプティカルコンタクト状態で接触しており、この接触状態は金型と上型とで各々ほぼ同等である。このために、プレス成形終了後、成形品を取り出す目的で上型を上昇させるか、あるいは下型を下降させた時に、図4に示したように、成形品10が上型1に接触したままの上型付着現象が時々起こる。この上型付着現象が発生すると、成形品を容易に取り出すことができなくなり、様々な不具合が生じ、装置の稼働率が大幅に低下したり、また、不良率が高くなってしまったりする。

【0003】そのため、従来から上型付着の防止策の検討がなされてきた。例えば、特開平5－823号公報には、上型と下型の接触面積に着目し、上型の接触面積を下型のそれよりも小さくすることによって上型から先に離型させる方法が提案されている。しかしながら、この方法では、成形品の形状に制約があり、様々な形状の光学素子に対応できないという不都合があった。

【0004】また、特開平5－43259号公報には、成形品が上型に付着しているか、下型に付着しているかをセンサーで検知してからその後の対応を施す方法が開示されている。しかしながら、この方法は、上型付着発生後のトラブル回避の工夫であり、上型付着の防止を達成したものではない上、制御機構が多く、装置が高価になるという欠点があった。

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【0005】また、特開平5－193961号公報には、胴型に切り欠き部を設け、そこに側方から成形品を挟持して離型させる離型部材が挿入される成形装置が開示されている。しかしながら、この成形装置では、成形品を離型部材で挟んで離型するという機械的な外力を用いているため、離型部材の形状を工夫しても成形品の外周部に小さなカケが発生し、カケが次回以降の成形面に影響を及ぼすという欠点があった。

【0006】さらに、特開昭63－77712号公報には、成形品が下型に接触して存在することを前提にして、胴型に設けた冷却ガス吹き出し口を用いて成形品を冷却することが開示されている。したがって、この方法では、上型に成形品が付着した場合には全く効果がなく、そのうえ金型を開けて冷却するために冷却ガスを吹き込むため、成形品が吹き飛ぶことがあるという問題点があった。

【0007】

【発明の目的】本発明は、前記従来技術の欠点を解消し、様々な形状に対応でき、簡単な構成で成形でき、カケなどの不具合を防止しつつ、成形品の上型付着を防止し、無理のない離型を連続的にかつ安定して行うことができ、高い精度を保ちながら高速で光学素子を成形しうる光学素子の成形装置を提供することを目的とする。

【0008】

【発明の概要】本発明は、まず最初に上型が冷却され、次いで成形品及び下型の順に冷却されるように冷却ガス通路及び冷却ガス吐出通路を胴型内に設けることによって上記目的を達成したものである。すなわち、本発明のガラス光学素子の成形装置は、ガラス素材を上型、下型及び胴型から成る成形型に収容して所望温度に加熱した状態でプレス成形し、その後冷却し、離型することにより所望の光学機能面を有するガラス光学素子を成形する成形装置において、胴型内に冷却ガス通路と冷却ガス吐出通路を少なくとも一対設け、該冷却ガス通路は胴型上部に冷却ガスの流入口と、成形位置の成形品の外周面に向けて開口する流出口とを有し、前記冷却ガス吐出通路は成形位置の成形品の外周面とほぼ同じ高さ位置にあることを特徴とする。

【0009】本発明のガラス光学素子の成形装置は、上記のように、胴型内に冷却ガス通路と冷却ガス吐出通路とを有するものであるが、これらは、成形型の大きさなどを考慮して少なくとも一対設ければよい。本発明の成形装置においては、上型部分を優先的に冷却するために、冷却ガス通路を胴型内の上型外周面に近い部分に設けることが好ましい。また、冷却ガス通路には冷却ガス供給装置から冷却ガスを供給することができる。冷却ガスとしては、通常、窒素ガスなどの不活性ガスを使用するのが好ましい。

【0010】さらに、冷却ガス通路の流出口と冷却ガス

吐出通路の位置関係や上型及び下型の周縁部の形状は、成形位置にあるときに、そこから金型を移動することなく、成形品の外周部に上型、下型及び胴型で囲まれる空間が形成されるようにするのが好ましい。

【００１１】

【実施例】次に、図面を参照して本発明の成形装置をさらに詳細に説明する。図１は、本発明の一実施例を示す成形装置を成形前の状態で示す略示断面図であり、図２は図１に示した装置を成形終了後の冷却工程の状態で示す略示断面図である。図１に示した成形装置は、上型１、下型２及び胴型３から成る成形部を有し、この胴型３には少なくとも一対の冷却ガス通路７及び冷却ガス吐出通路８が設けられている。また、冷却ガス通路７には冷却ガス供給装置５より冷却ガスが供給される。なお、６は冷却ガス供給口であり、９はスペーサーである。

【００１２】この成形装置において、成形終了後の冷却時に成形品がガラス転移点以下の温度になった後に、冷却ガス供給装置５により冷却ガスを冷却ガス通路７に流入させる。このとき、冷却ガスは上型１の外周部を冷却しながら冷却ガス通路７中を流通するので、冷却ガス通路７は胴型３内に上型１の外周面に近い位置に設けられるのが好ましい。冷却ガス通路７を出た冷却ガスは、成形品１０の外周部に直接あたる。

【００１３】成形品１０の外周部の周りには、上型１、下型２及び胴型３で囲まれる空間が形成されているので、冷却ガスが成形品の外周部を回り、冷却する。また、冷却ガス吐出通路８の口径が冷却ガス通路７の流出口の構成よりも小さい方が冷却ガスの外周回りの流れがよくなり、冷却効率がよくなるため、好ましい。こうして成形品の外周部を冷却した後に、冷却ガス吐出通路８から冷却ガスが成形部外に流出するので、金型及び成形品外周の冷却効果を損なうこともない。さらに、上記の冷却ガスの流れを実現するためには、成形室内の圧力を成形部外の圧力より高く保つ必要がある。

【００１４】図１に示した成形装置を用いて光学素子を成形するには、まず下型２を下げ、その成形面にガラス素材４を供給する。その供給には、吸着部材あるいはチェックなどを用いる（図示せず）。ガラス素材４の供給後に、下型２を上昇させ、ガラス素材４が上型１の成形面に接触するようにする。その後に成形部を加熱し、ガラス素材４が軟化し、成形最適温度（例えば４９０℃）になったところで、加圧成形し、次いで冷却工程に入る。ガラス素材４のガラス転移点以下（例えば４３０℃）になったところで、冷却ガス供給口７から冷却ガス供給装置５に冷却ガス、例えば窒素ガス等の不活性ガスを供給し、この冷却ガス供給装置５から冷却ガス通路７に流入させる。冷却ガスは、通常、２ｋｇｆ／ｃｍ^{2}で、１～１０リットル／分の流量で流入させるのが好ましい。

【００１５】成形品１０が変形しない温度（例えば４２０～４２５℃）になったところで、成形圧力を０にし、離型を待つ。ここで、上型１の外側の胴型３の中を常温の冷却ガスが通過することにより、上型１が下型２よりも早く冷却され、成形品１０の上型１側部分からの離型が促進される。冷却ガスは、胴型３の冷却ガス通路７を図２に示した矢印のように通って成形品１０の外周部に直接あたり、外周空間を回って冷却ガス吐出通路８から成形部外に流出する。このことから、下型成形面温度＞上型成形面温度＞成形品中央温度＞成形品外周温度という温度条件が実現される。したがって、冷却工程においては、図３に示したように（ａ）→（ｂ）→（ｃ）のように離型が起こり、成形品は取り出し時に下型２上に必ずあり、上型付着は完全に解消される。また、成形品が必ず下型２の成形面上に載っているため、取り出し時に簡単な取り出し部材で取り出すことができる。

【００１６】上記実施例には、両凸レンズの成形について示したが、両凹レンズの成形を同様の方法で行っても上型付着によるトラブルは起こらなかった。

【００１７】

【発明の効果】本発明の成形装置は、簡単な構成で、効率よく冷却を行うことができ、冷却時間の短縮と上型付着の防止を実現することができ、安定して良品を提供することができるため、大幅なコストダウンが可能になる。

【図面の簡単な説明】

【図１】本発明の一実施例を示す光学素子の成形前の状態で示す成形装置の略示断面図である。

【図２】冷却工程の状態で示す図１に示した成形装置の略示断面図である。

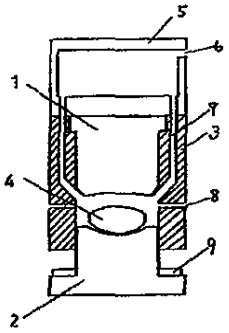
【図３】本発明の成形装置を用いた冷却工程における成形品の離型状態を示す工程説明図である。

【図４】従来の成形装置における成形品の離型状態を示す説明図である。

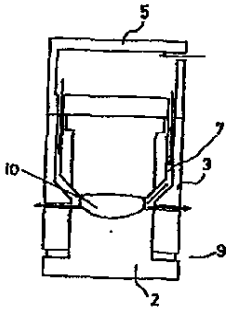
【符号の説明】

１　上型
２　下型
３　胴型
４　ガラス素材
５　冷却ガス供給装置
６　冷却ガス供給口
７　冷却ガス通路
８　冷却ガス吐出通路
９　スペーサ
１０　成形品

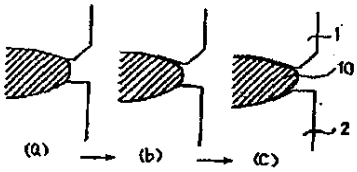
【図1】



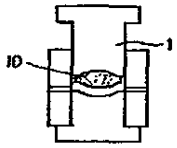
【図2】



【図3】



【図4】



PAT-NO: JP407172845A

DOCUMENT-IDENTIFIER: JP 07172845 A

TITLE: DEVICE FOR FORMING GLASS OPTICAL ELEMENT

PUBN-DATE: July 11, 1995

INVENTOR-INFORMATION:
NAME
FUSE, HIROAKI

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NAME COUNTRY
ASAHI OPTICAL CO LTD N/A

APPL-NO: JP05321456

APPL-DATE: December 21, 1993

INT-CL (IPC): C03B011/00, C03B011/12

ABSTRACT:

PURPOSE: To provide a device for forming an optical element by which the sticking of a formed product to an upper die is prevented and the formed product is smoothly, continuously and stably released from the die.

CONSTITUTION: A glass material 4 is placed in a mold consisting of an upper die 1, lower die 2 and barrel die 3, heated to a desired temp., press-formed and then released from the mold to form a glass optical element having a desired optically functional face by this device. At least a couple of the colling gas passage 7 and cooling gas passage 8 are

provided in the barrel die,
the passage 7 has a cooling gas inlet at the upper part of the barrel die and
the cooling gas outlet opened toward the outer peripheral face of the formed
product at its forming position, and the passage 8 is made almost flush with
the outer peripheral face of the formed product at its forming position.

PATENT ABSTRACTS OF JAPAN

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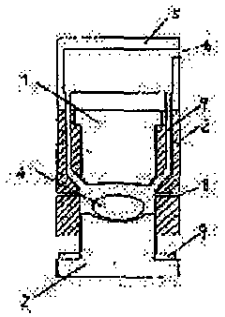
(22)Date of filing : **21.12.1993**

(71)Applicant : **ASAHI OPTICAL CO LTD**
(72)Inventor : **FUSE HIROAKI**

(54) DEVICE FOR FORMING GLASS OPTICAL ELEMENT

(57)Abstract:
PURPOSE: To provide a device for forming an optical element by which the sticking of a formed product to an upper die is prevented and the formed product is smoothly, continuously and stably released from the die.
CONSTITUTION: A glass material 4 is placed in a mold consisting of an upper die 1, lower die 2 and barrel die 3, heated to a desired temp., press-formed and then released from the mold to form a glass optical element having a desired optically functional face by this device. At least a couple of the colling gas passage 7 and cooling gas passage 8 are provided in the barrel die, the passage 7 has a cooling gas inlet at the upper part of the barrel die and the cooling gas outlet opened toward the outer peripheral face of the formed product at its forming position, and the passage 8 is made almost flush with the outer peripheral face of the formed product at its forming position.



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[Patent number]
[Date of registration]
[Number of appeal against examiner's decision of rejection]
[Date of requesting appeal against examiner's decision of rejection]
[Date of extinction of right]

* NOTICES *

CLAIMS

[Claim(s)]

[Claim 1] It is forming equipment which fabricates the glass optical element which has a desired optical functional side by having the following, carrying out press forming in the state characterized by locating the aforementioned coolant-gas regurgitation path in the almost same height position as the peripheral face of the mold goods of a forming position where held the glass material in the form block which consists of a punch, female mold, and a mold, and it heated to request temperature, cooling after that, and releasing from mold. Preparing a coolant-gas path and at least one pair of coolant-gas regurgitation path in a mold, this coolant-gas path is the input of coolant gas to the mold upper part. The tap hole which carries out opening towards the peripheral face of the mold goods of a forming position.

[Claim 2] Forming equipment of the glass optical element according to claim 1 which established the coolant-gas path in the portion near the punch peripheral face in a mold.

[Claim 3] Forming equipment of the glass optical element according to claim 1 which prepared the coolant-gas feeder in the coolant-gas path.

[Claim 4] Forming equipment of a glass optical element given in any 1 term of the claims 1-3 in which the space surrounded by the punch, female mold, and the mold is formed, without moving metal mold to the periphery section of mold goods when it is in a forming position.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to the forming equipment used for operation of the direct pressing method which carries out direct press forming of the glass optical element which has an optical functional side.
[0002]
[Description of the Prior Art] In the direct pressing method, the optical surface of mold goods and the forming side of the metal mold corresponding to it touch in the state of an optical contact at the time of the completion of forming, and this contact state is almost equivalent respectively at metal mold and a punch. For this reason, after a press-forming end, when raising a punch in order to take out mold goods, or dropping female mold, as shown in drawing 4 , a punch [that mold goods 10 have contacted the punch 1] attachment phenomenon sometimes happens. If a type attachment phenomenon besides occurs, it becomes impossible to take out mold goods easily, and various faults arise, the operating ratio of equipment will fall sharply and a percent defective will become high.
[0003] Therefore, examination of the preventive measure of punch adhesion has been made from the former. For example, the method which JP,5-823,A is made to release from mold previously from a punch by making the touch area of a punch smaller than that of female mold paying attention to the touch area of a punch and female mold is proposed. However, by this method, the configuration of mold goods had restrictions and there was un-arranging [that it could not respond to the optical element of various configurations].
[0004] Moreover, after detecting by the sensor whether mold goods have adhered to the punch, or it has adhered to female mold, the method of giving subsequent correspondence is indicated by JP,5-43259,A. However, this method is the device of the trouble evasion after punch adhesion generating, and had the fault that there are many controlling mechanisms when it is not what attained prevention of punch adhesion, and equipment became expensive.
[0005] Moreover, the notching section is prepared in a mold and the forming equipment with which the mold release member which makes mold goods pinch and release from mold there from the side is inserted is indicated by JP,5-193961,A. since however,] the mechanical external force of releasing from mold on both sides of mold goods by the mold release member is used with this forming equipment -- mold release -- even if it devised the configuration of a member, small KAKE occurred in the periphery section of mold goods, and there was a fault that KAKE affected the forming side on and after next time
[0006] Furthermore, cooling mold goods using the coolant-gas diffuser prepared in the mold on the assumption that mold goods contact and existed in female mold is indicated by JP,63-77712,A. Therefore, by this method, when mold goods adhered to a punch, it was completely ineffective, and in order to open metal mold moreover, to cool and to blow coolant gas, there was a trouble that mold goods might blow away.
[0007]
[Objects of the Invention] this invention aims at offering the forming equipment of the optical element which can fabricate an optical element at high speed, preventing punch adhesion of mold goods, being stabilized continuously, being able to perform impossible mold release which is not, and maintaining a high precision being able to cancel the fault of the aforementioned conventional technology, being able to respond to various configurations, being able to fabricate with easy composition, and preventing faults, such as KAKE.
[0008]
[Summary of the Invention] this invention attains the above-mentioned purpose by preparing a coolant-gas path and a coolant-gas **** path in a mold so that a punch may be cooled first and it may be cooled subsequently to the order of mold goods and female mold. Namely, the forming equipment of the glass optical element of this invention In the forming equipment which fabricates the glass optical element which has a desired optical functional side by carrying out press forming, cooling after that, and releasing from mold in the state where held the glass material in the form block which consists of a punch, female mold, and a mold, and it heated to request temperature A coolant-gas path and at least one pair of coolant-gas **** path are prepared in a mold. this coolant-gas path in the mold upper part The input of coolant gas, It has the tap hole which carries out opening towards the peripheral face of the mold goods of a forming position, and is characterized by locating the aforementioned coolant-gas **** path in the almost same height position as the peripheral face of the mold goods of a forming position.
[0009] What is necessary is just to prepare at least one pair of these in consideration of the size of a form block etc., although the forming equipment of the glass optical element of this invention has a coolant-gas path and a coolant-gas **** path in a mold as mentioned above. In the forming equipment of this invention, in order to cool a punch portion preferentially, it is desirable to

establish a coolant-gas path in the portion near the punch peripheral face in a mold. Moreover, coolant gas can be supplied to a coolant-gas path from a coolant-gas feeder. As coolant gas, it is usually desirable to use inert gas, such as nitrogen gas.
[0010] Furthermore, as for the tap hole of a coolant-gas path, the physical relationship of a coolant-gas regurgitation path, or the configuration of the periphery section of a punch and female mold, it is desirable that the space surrounded by the punch, female mold, and the mold is formed in the periphery section of mold goods, without moving metal mold from there, when it is in a forming position.
[0011]
[Example] Next, with reference to a drawing, the forming equipment of this invention is further explained to a detail. Drawing 1 is a sketch cross section shown in the state before fabricating the forming equipment in which one example of this invention is shown, and drawing 2 is the sketch cross section showing the equipment shown in drawing 1 in the state of the cooling process after a forming end. The forming equipment shown in drawing 1 has the forming section which consists of a punch 1, female mold 2, and a mold 3, and the coolant-gas path 7 and the coolant-gas regurgitation path 8 of a couple are established in this mold 3 at least. Moreover, coolant gas is supplied to the coolant-gas path 7 from the coolant-gas feeder 5. In addition, 6 is a coolant-gas feed hopper and 9 is a spacer.
[0012] After mold goods become the temperature below a glass transition point at the time of cooling after a forming end, coolant gas is made to flow into the coolant-gas path 7 by the coolant-gas feeder 5 in this forming equipment. Since coolant gas circulates the inside of the coolant-gas path 7 at this time, cooling the periphery section of a punch 1, as for the coolant-gas path 7, it is desirable to be prepared in a mold 3 in the position near the peripheral face of a punch 1. The coolant gas which came out of the coolant-gas path 7 hits the periphery section of mold goods 10 directly.
[0013] Since the space surrounded by the punch 1, female mold 2, and the mold 3 is formed in the surroundings of the periphery section of mold goods 10, coolant gas cools the periphery section of mold goods the surroundings. Moreover, since the flow of the circumference of the periphery of coolant gas becomes [the one where the aperture of the coolant-gas regurgitation path 8 is smaller than the composition of the tap hole of the coolant-gas path 7] good and cooling efficiency becomes good, it is desirable. In this way, since coolant gas flows out of the coolant-gas regurgitation path 8 into a forming outside after cooling the periphery section of mold goods, the cooling effect of metal mold and a mold-goods periphery is not spoiled. Furthermore, in order to realize the flow of the above-mentioned coolant gas, it is necessary to keep the pressure of the forming interior of a room higher than the pressure of a forming outside.
[0014] In order to fabricate an optical element using the forming equipment shown in drawing 1 , female mold 2 is lowered first and the glass material 4 is supplied to the forming side. the supply -- adsorption -- a member or a check is used (not shown) Female mold 2 is raised and it is made for the glass material 4 to contact the forming side of a punch 1 after supply of the glass material 4. The forming section is heated after that and the glass material 4 softens, and pressing is carried out and, subsequently to a cooling process, it enters in the place which became forming optimum temperature (for example, 490 degrees C). Inert gas, such as coolant gas, for example, nitrogen gas etc., is supplied to the coolant-gas feeder 5 from the coolant-gas feed hopper 7, and it is made to flow into the coolant-gas path 7 from this coolant-gas feeder 5 in the place which became below the glass transition point (for example, 430 degrees C) of the glass material 4. Coolant gas is usually 2 kgf/cm2. It is desirable to make it flow by 1-10l. the flow rate for /.
[0015] In the place which became the temperature (for example, 420-425 degrees C) which mold goods 10 do not deform, a compacting pressure is set to 0 and it waits for mold release. Here, when the coolant gas of ordinary temperature passes through the inside of the mold 3 of the outside of a punch 1, a punch 1 is cooled earlier than female mold 2, and the mold release from a part for punch 1 flank of mold goods 10 is promoted. It passes along coolant gas like the arrow which showed the coolant-gas path 7 of a mold 3 to drawing 2 , it turns per direct and around periphery space to the periphery section of mold goods 10, and flows out of the coolant-gas regurgitation path 8 into a forming outside. From this, the temperature conditions of degree > mold-goods of degree > punch fabrication surface temperature of female mold fabrication surface temperature central temperature > mold-goods periphery temperature are realized. Therefore, in a cooling process, as shown in drawing 3 , mold release takes place like (a) ->(b) -> (c), mold goods are taken out, and are sometimes always on female mold 2, and punch adhesion is canceled completely. Moreover, since mold goods have surely appeared on the forming side of female mold 2, it can take out by the easy takeoff-connection material at the time of ejection.
[0016] Although fabrication of a biconvex lens was shown in the above-mentioned example, even if it fabricated the biconcave lens by the same method, the trouble by punch adhesion did not arise.
[0017]
[Effect of the Invention] Since the forming equipment of this invention can be cooled efficiently, can realize shortening of a cooldown delay, and prevention of punch adhesion, is stabilized and can offer an excellent article with easy composition, a large cost cut is attained.

[Translation done.]